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ABSTRACT

In order to determine what aspects of information from prose are available for recall after one presentation of a passage and what aspects are learned with additional presentations, two passages were divided into idea units. These units were placed in a logical hierarchical structure for each passage, and scores were assigned to the idea units on the basis of their position in the structure. Sixty-nine undergraduates were divided into three groups equally; each group heard the passages once, twice, or three times before recalling. Effects of the logical structure were seen in the kinds of idea units remembered, the stability of these units in consecutive recalls, and the tendency for clustering of idea units on this basis. In addition, serial position, importance of idea units, and order of recall were examined with the recall data. It was found that units high in the logical hierarchy were recalled more frequently than those lower in the hierarchy, that subjects tended to recall groups of units from the passages which were related to one another in the hierarchical structure, and that the stability of each unit recall was substantially related to its position in the logical structure of the passage. Figures and a bibliography are included. (Author/AW)

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WHAT IS RECALLED AFTER HEARING A PASSAGE?

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Abstract

In order to determine what aspects of information from prose are available for recall after one presentation of a passage, and what aspects are learned with additional presentations, two passages were divided into idea units. These units were placed in a logical, hierarchical structure for each passage, and scores were assigned to the idea units on the basis of their position in the structure. Effects of the logical structure were seen in the kinds of idea units which were remembered, the stability of these units in consecutive recalls, and the tendency for clustering of idea units on this basis. In addition, serial position, importance of idea units, and order of recall were examined with the recall data.

What is Recalled After Hearing a Passage?

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After hearing a passage read, people are unable to recall all the information which it contained. With a group of people, some ideas from the passage are recalled by almost everyone, whereas other ideas are recalled by very few. The study to be reported in this paper was initiated to investigate the effect of certain variables which may be influencing which information tends to be recalled from a passage. The variables investigated were the position of ideas in the logical structure of the passage, the perceived importance of ideas to the passage, and the serial position of the ideas in the passage.

Three general questions will be dealt with. First, what ideas tend to be recalled after hearing a passage only once? Second, what additional ideas are recalled after further presentations of the passage? Third, what are other characteristics of recall from prose?

In 1937 Welborn and English reviewed the research dealing with substantive learning and retention of prose. Two issues they discussed were the effect of serial position on recall, and whether repetitions increase retention. They reported four studies investigating the effects of serial position, two of which (Dell, 1912; Wilson, 1931) found no effect on recall, and the others (Shaw, 1896; Jersild, 1929) found the first sentences in the stories used to be better recalled than those appearing later. In addition, Shaw found a general tendency to recall

the first part of a story better than the last part.

Serial position effects are consistently found in recall of word lists (Robinson & Brown, 1926; Raffel, 1936; Murdock, 1962; Postman & Phillips, 1965; Glanzer & Cunitz, 1966). However, Richardson and Voss (1960), who used lists which varied in their similarity to English, and with verbatim scoring, reported no serial position effects. Frase (1969), scoring recall of sentences in a passage, found that first sentences were remembered better than those occuring later in the passage. Deese and Kaufman (1957) found not only a primacy effect, but a recency effect as well, thus yielding a serial position curve similar to those obtained in serial anticipation learning of word lists. Thus, serial position effects have often, but not always, been obtained with recall from prose. The nature of these effects has varied from study to study. Undoubtedly, much of this difference is due to different materials and methods used in the studies, but the exact influence of these variables is unknown at present.

Concerning the effects of repetition on recall from prose, Welborn and English (1937) concluded that "repetition is not of major importance in logical memory." Of the seven studies cited to support this conclusion, only four actually dealt with the effects of repetition on recall (Good, 1926; Shaffer, 1927; Jersild, 1928; Killian, English & Welborn, 1934) and all found greater recall after multiple presentations than after a single presentation. Welborn and English's conclusion reflects their feeling that the increase in number of questions correct which resulted from additional presentations was not sufficient to justify the amount of extra time required. Thus, they were primarily concerned with study-time efficiency. The results reported in the

studies they reviewed are generally consistent with the learning curves typically obtained in the learning of other sorts of materials (Deese, 1958); that is, there is a negatively accelerated increase in performance with extra learning time. More recent studies have also confirmed this generalization (Cofer, 1941; Rothkopf, 1968).

The influence on recall of perceived importance of ideas in a passage was investigated by Johnson (1970) who reported a significant relationship. He found that ideas perceived as being important to the passage were more likely to be recalled than those seen as being of less importance.

It is well to keep in mind that variables that influence which ideas are recalled after a single presentation may not be the same as those which determine which ideas are added as a result of additional presentations of the passage. However, the authors are not aware of any previous studies which have dealt with this question.

The present study, in addition to investigating whether certain variables are related to the recall frequency of ideas after one or more presentations, also provided data for examining other aspects of recall from prose. Recent research has demonstrated that the order in which word lists are recalled in a free recall task is strongly influenced by the associative and conceptual relations among the words (Tulving & Pearlstone, 1966; Bower, Clark, Lesgold & Winzenz, 1969). Data from the present study were examined to determine whether this held true for the recall of ideas from a passage as well. In addition, Tulving (1967) has found that with free recall of words from a list there is considerable instability in just which words are produced on successive recall attempts with no intervening presentations. With three attempts at

recalling a list, he found that only 50% of all the words remembered by a S were produced on all three attempts. In the present study, Ss were asked to recall a passage twice with no intervening presentation to provide data which could be compared to Tulving's.

In the present study, recall was scored in terms of idea units. The passages were analyzed subjectively in an attempt to identify what seemed to be individual ideas stated in the text; these ideas could consist of words or phrases. The passages were scored in terms of which of these idea units were present in a S's written recall of the passages he had heard. A similar scoring method has been employed by Henderson (1903), Cofer (1941), Levitt (1956), Horowitz and Berkowitz (1967), King (1960, 1961, 1966, 1968a, 1968b, 1968c), King and Schultz (1960), King and Yu (1962), King and Harper (1967), Howe (1970), and Todd and Kessler (1971). Johnson (1970) employed a slightly different method to identify the units scored, but one which is still closely related to that used here.

METHOD

Materials

The prose used in this experiment consisted of two passages which were extracted from recent articles appearing in Scientific American magazine. The first, entitled "The Therapeutic Community" (hereafter referred to as the TTC passage), is 481 words long, and deals with the characteristics of a particular approach to the treatment of the mentally ill. The second, which presents more specific and numerical information, is entitled "Fast Breeder Reactors" (referred to as the FBR passage), contains 502 words, and deals with problems of electric power generation, pollution, finite resources, and the nuclear breeder reactor as a

possible solution to these problems. These passages were tape recorded in a woman's voice at approximately 100 words per minute.

Procedure

Sixty-nine undergraduates enrolled in an introductory psychology course at Cornell University participated in the experiment. They were divided into three experimental groups of 23 Ss each. One group heard each passage once before recalling it, the second group heard each passage twice before recalling, and the third group heard each passage three times. After hearing a passage the designated number of times, Ss were asked to write down everything they could remember from the passage in any form convenient for them. All Ss heard the TTC passage first. After recalling the second passage (FBR), Ss handed in their written recall, then were asked to recall it again with no intervening presentation. Ss were tested in groups, and recall was always continued until all Ss indicated that they could recall nothing more. This typically amounted to about 12 minutes for each passage.

Identifying idea units

The division of each passage into idea units was carried out subjectively. The judge selected the most important idea in the first paragraph, then proceeded to select other ideas that described or gave information about this main idea. Each resulting idea unit was felt to be a single, meaningful piece of information conveyed by the passage, whether it consisted of a word, a definition, or a phrase in the passage. The TTC passage yielded 78 idea units, while the FBR passage contained 80 units.

Identifying logical structure

The idea units identified were next arranged into a tree structure,

which showed the basic hierarchical structure among the ideas in the passage.

As a test of reliability, two independent judges, an undergraduate and a graduate student, were also asked to arrange the idea units in an outline of the passage. A statement of each unit was printed on an individual slip of paper. The judges read each passage, then placed these slips in outline form on a sheet of paper marked off with a series of vertical lines. A main idea was to be placed at the extreme left of the paper. An idea unit directly under it in a logical relationship was to be placed under it physically and displaced one column to the right. This procedure was continued until all idea units of a passage were placed in the outline form. Throughout the outlining task the judges had copies of the passage present and were free to refer to them at any time. The outlines produced were then converted to tree structures and compared to the original structure produced. For the TTC passage, of the 78 idea units the judges placed 72 and 74 of the units in positions identical to the original structure. For the FBR passage, having 80 idea units, 71 and 72 of the units were in positions identical to the original structure. On those units on which a judge did not agree with the original placement of a unit, the judges did not agree between themselves. It was concluded that this method of identifying the logical structure of the passages was reliable, producing 91.5% agreement among judges, and that the original structures could be accepted as describing the logical relationships among the idea units in these passages.

From the resulting hierarchical structures, each idea unit was assigned three numbers to index aspects of its position in the logical hierarchy. The first number, called the Hierarchy Depth Score, was the

level in the hierarchy at which the unit was placed. Main ideas which stood at the top of the hierarchy were assigned the number 1, those immediately under them were assigned the number 2, and so on. The second number, called the Units Beneath Score, was obtained by counting the number of idea units linked by downward paths from the unit being considered. Finally a third number, the Combined Hierarchy Score, was obtained by first, subtracting all Hierarchy Depth Scores from a constant, then converting these inverted Hierarchy Depth Scores and the log Units Beneath Scores to standard scores and summing these for each idea unit. Thus, it combined the two earlier scores, equally weighted, into a single index.

Rated importance of idea units

Ten undergraduates each received a copy of each passage together with a list of the statements of idea units. They rated each unit on a seven-point scale as to its importance to the message of the passage. The average rating of each unit was accepted as the Rated Importance Score for that unit.

To examine the reliability of the ratings, the raters were randomly divided into two groups of five each. The mean rating of each item by each group was computed. These correlated .76 for the TTC passage and .84 for the FBR passage.

Scoring the recalls

Each of the sixty-nine Ss wrote three recalls which were all scored by the same scorer, a graduate student in educational psychology. In scoring, spelling errors were ignored, and an attempt was made to judge whether or not each idea unit was present in a substantially correct form. For each S's recall a record was made of which idea units were present and the order in which they were recalled, as well as the total

number recalled.

A sample of 20 recalls was selected at random and scored by a second scorer, a graduate student in biological science. Of a total of 1,584 idea units which could have been recalled, the scorers agreed on 1,508, finding 584 units present and 924 absent. They disagreed on 76 idea units, an average of about 4 per recall. The correlation between the total scores assigned to each S's recall by the two scorers was .987.[1]

RESULTS

Total recall

Table 1 presents the mean number of idea units recalled for each passage after different numbers of presentations. One-way analyses of variance on each passage separately showed that additional presentations significantly increased recall ($p < .001$). An examination of Table 1 indicates that this increase with additional presentations is negatively accelerated. In addition, the number of units recalled on the two recall attempts of the FBR passage was virtually identical.

Recall frequency of idea units

Serial Position - The number of Ss who recalled each idea unit, hereafter referred to as the recall frequency of the unit, was plotted against its serial position in presentation for each passage separately. An examination of the resulting graphs did not reveal either primacy or recency effects. The first half of the TTC passage was recalled better

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1. Further description of the methods used can be found in Meyer, B. J. F. Idea Units Recalled from Prose in Relation to their Position in the Logical Structure, Importance, Stability, and Order in the Passage. M.S. Thesis, Cornell University, 1971.

Table 1

Mean Number of Idea Units Recalled After Different Number of Presentations

Passage	Number of Presentations		
	1	2	3
TTC Passage	14.17	29.30	34.04
FBR Passage - First Recall	21.35	38.22	43.35
FBR Passage - Second Recall	21.57	38.09	44.26

than the last half, but this tendency disappeared with additional presentations. No such tendency was present with the FBR passage. Thus, no consistent serial position effects were observed.

Hierarchy Depth Score - The recall frequency of each idea unit was plotted against its Hierarchy Depth Score for each passage. For the data after a single presentation, the resulting scatter-plot was triangular in shape. Units low in the hierarchy were infrequently recalled, but items high in the hierarchy had a much greater spread in recall frequency.

For each passage the idea units were divided into three nearly equal sets according to their Hierarchy Depth Scores: high, medium, and low. Two-way Analyses of Variance of the recall frequency data (Hierarchy Depth Score sets by number of presentations) showed the same pattern for both passages: both main effects were significant at the .001 level and there was no significant interaction ($F(4, 132) = 2.40$ and 0.75). Figures 1 and 2 summarize the data graphically with recall frequencies converted to proportions. Units high in the logical hierarchy (that is, units with low Hierarchy Depth Scores) are recalled more frequently than those lower in the hierarchy, with no consistent difference between units in the middle and low in the hierarchy. Recall of units at all levels increases about equally with additional presentations.

Units Beneath Score - The idea units for each passage were again divided into three sets: those units having high, medium, and low Units Beneath Scores. Again, two-way Analyses of Variance for the two passages showed both main effects to be significant at the .001 level. In addition, the interaction was significant for the FBR passage ($F(4, 132) = 3.36$, $p < .05$), though not for the TTC passage ($F = 1.50$). Figures 3 and 4 show the nature of these effects. Units having higher Units Beneath Scores tend to be recalled better and this difference is maintained over trials.

Figure 1

Relation Between Hierarchy Depth Scores of Idea Units and Recall after 1, 2 or 3 Presentations of the TTC Passage

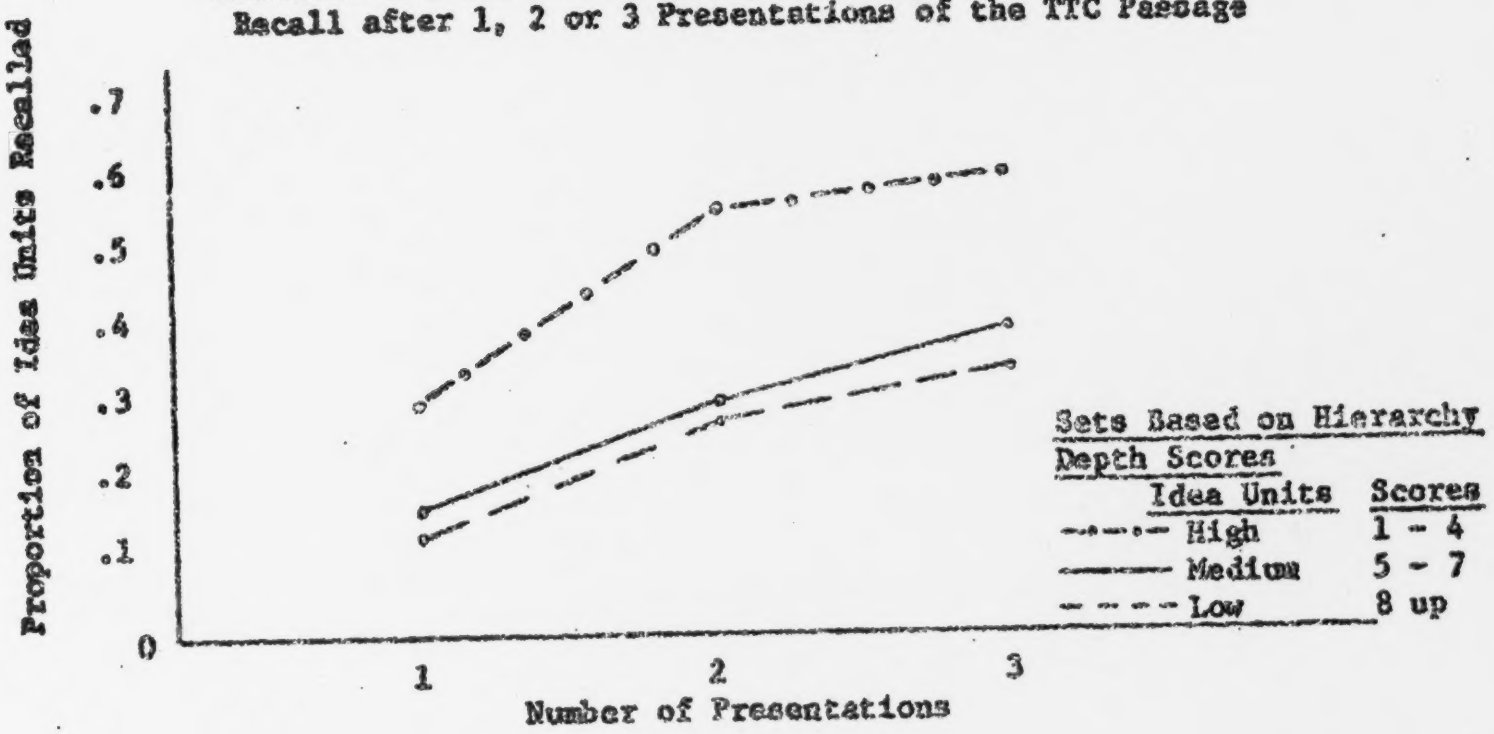


Figure 2

Relation Between Hierarchy Depth Scores of Idea Units and Recall after 1, 2 or 3 Presentations of the FBR Passage

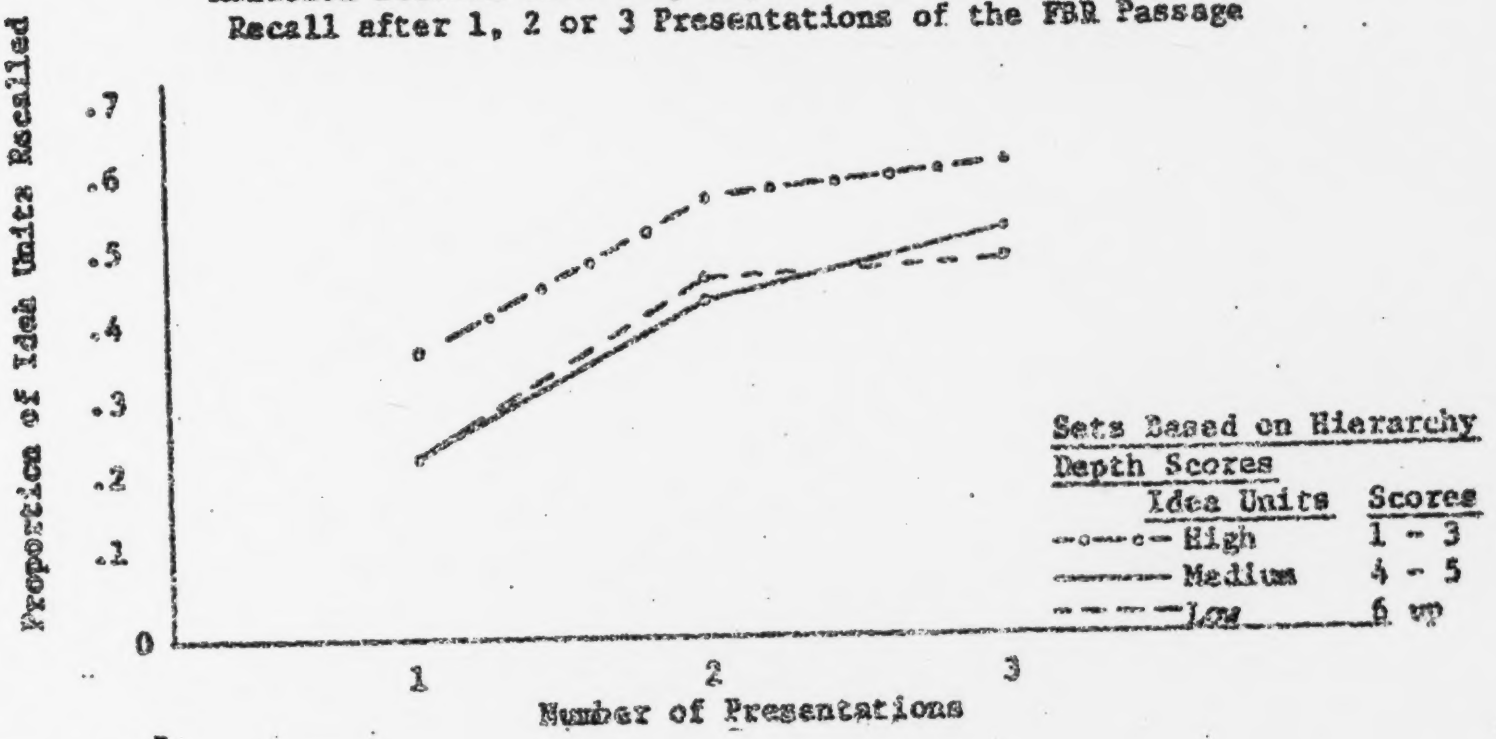


Figure 3

Relation Between Units Beneath Scores of Idea Units and Recall after 1, 2 or 3 Presentations of the TTC Passage

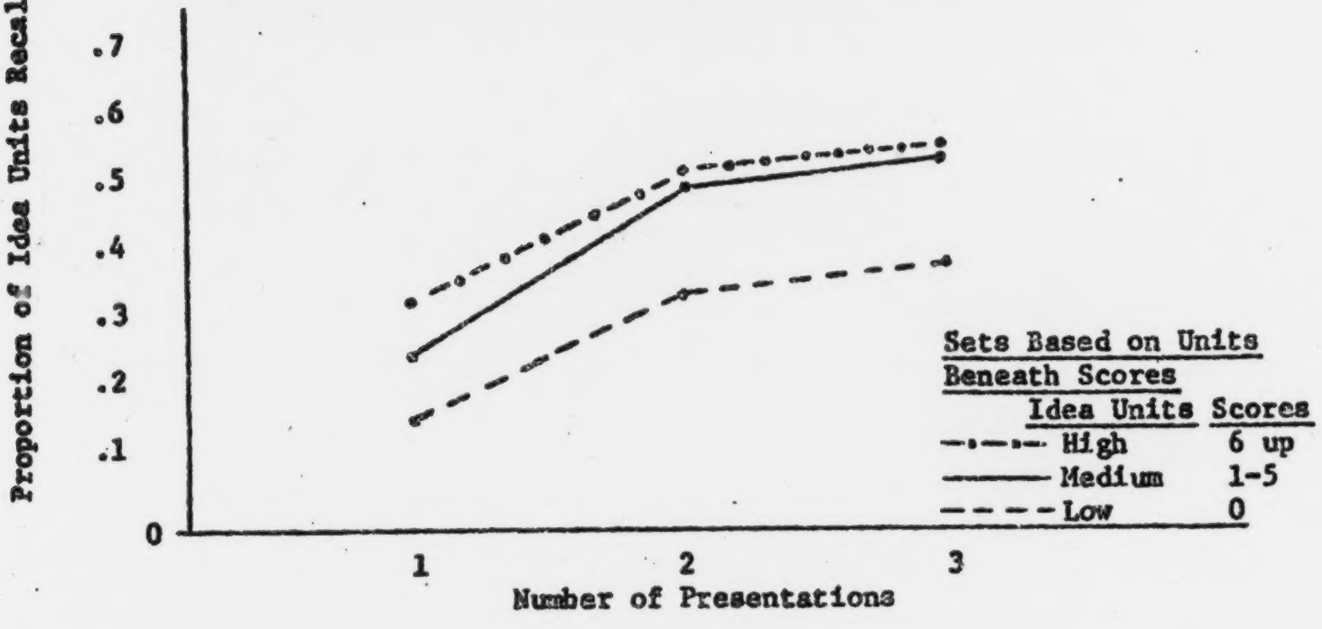
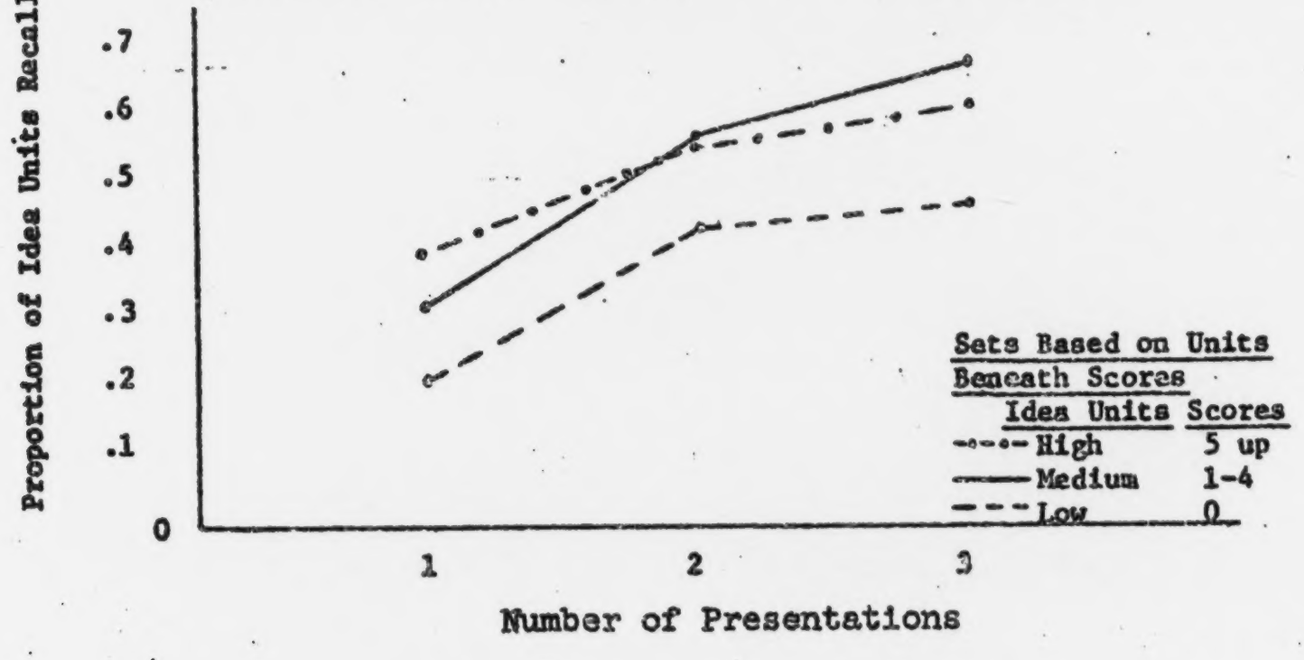


Figure 4

Relation Between Units Beneath Scores of Idea Units and Recall after 1, 2 or 3 Presentations of the FBR Passage



Both graphs indicate that the units having medium scores on this measure tend to increase slightly faster over trials, a tendency largely responsible for the significant interaction in the FBR passage. In this passage, units having medium scores were actually recalled better than those having high scores after 2 and 3 presentations.

Combined Hierarchy Score - The recall frequency of each unit was plotted against its Combined Hierarchy Score for each passage separately. The resulting scatter plots indicated a linear relationship between the variables, and a general shape consistent with the assumptions of homoscedasticity underlying the Pearson product-moment correlation coefficient (McNemar, 1968). Therefore, correlations were computed, yielding coefficients of .55 ($p < .01$) for the TTC passage and .42 ($P < .01$) for the FBR passage after a single presentation. These dropped to .49 after 2 and 3 presentations of the TTC passage, and to .25 and .27 for the FBR passage; all correlations are significant at least at the .05 level. Thus, the Combined Hierarchy Score is significantly related to the recall of idea units from the passages, and this relationship is maintained over trials.

On the basis of their Combined Hierarchy Scores, the idea units were grouped into three categories for each passage separately, high, medium, and low. The two-way Analyses of Variance for the passages showed both main effects to be significant at the .001 level. A significant interaction was found for the TTC passage ($F(4, 132) = 3.56$), but not for the FBR passage ($F = .25$). Figures 5 and 6 depict these relationships. Idea units high in the logical hierarchy are recalled much more frequently than those in the middle and lower portions of the hierarchy. Consistent differences between medium and low units were not found; in the TTC passage these groups are significantly different,

Figure 5

Relation Between Combined Hierarchy Scores of Idea Units And Recall After 1, 2 or 3 Presentations of the TTC Passage

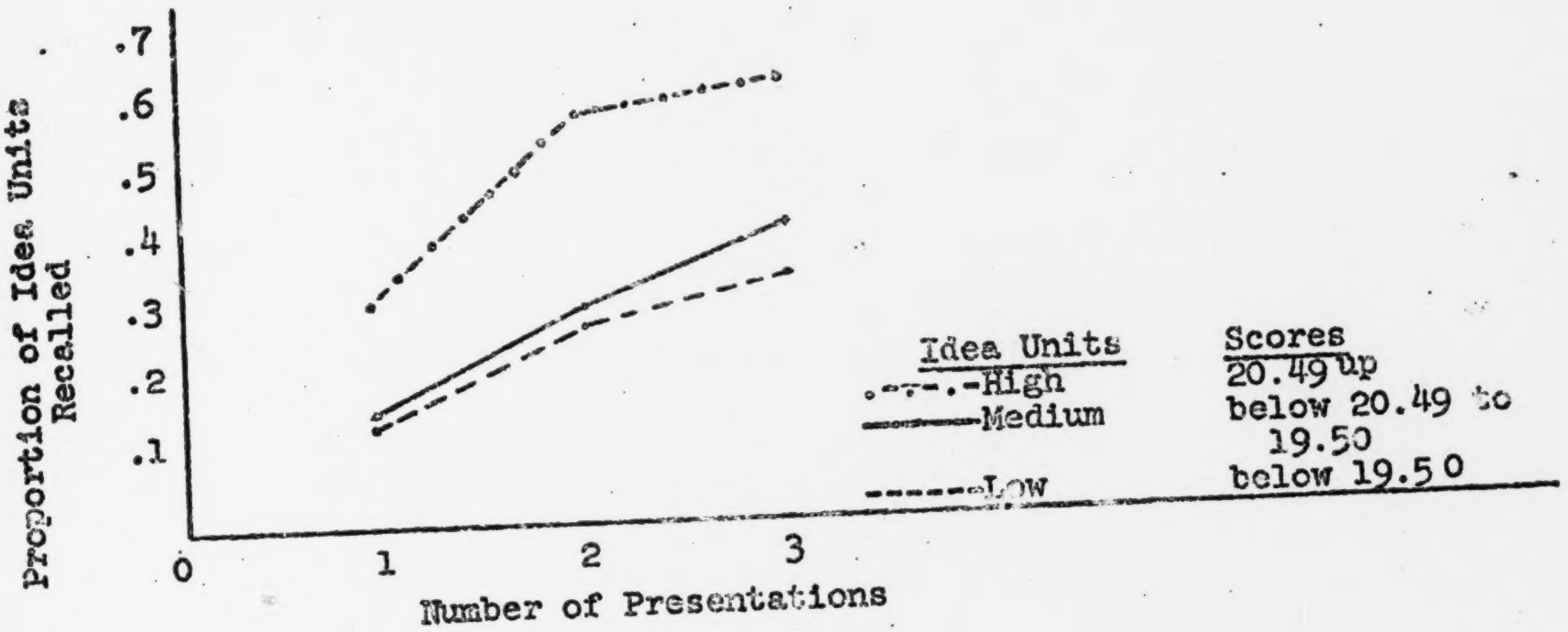
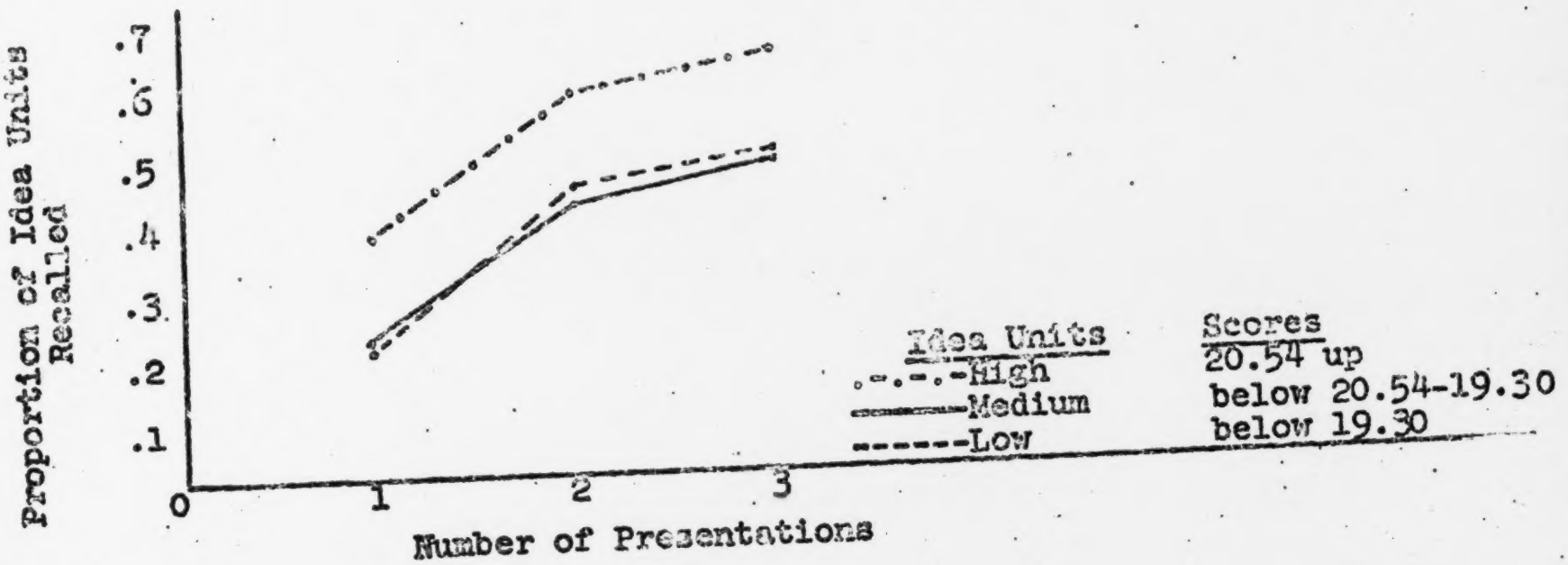


Figure 6



but in the FBR passage they are not.

Rated Importance - The idea units for each passage were divided into three sets according to their Rated Importance Scores: high, medium and low. Again, two-way Analyses of Variance were carried out for the two passages separately. Both main effects were significant at the .001 level for the FBR passage. For the TTC passage the effect for Rated Importance Score was significant at the .025 level ($F(2, 132) = 4.33$). Interactions were not significant. Figures 7 and 8 show the nature of these effects. Rated importance had very little effect on the TTC passage; what effect there was resulted primarily from a superiority of the units rated high in importance. The effect was substantially greater for the FBR passage, but again the low and medium units did not differ much.

Order of recall

There was a tendency for Ss to recall idea units in the same order that they were presented. To obtain a measure of the degree to which this occurred, the recall data of 5 Ss who heard the passages once were selected from each passage and the following analysis performed. The units each S recalled were numbered according to the order that they were recalled, with the first unit recalled being given the number 1, the next number 2, etc. In addition, these units were rank-ordered according to the order of their presentation in the passage. These two sets of numbers were then correlated for each S. The average correlation for the 10 recalls was .94. The same analysis performed on data after 2 and 3 presentations yielded average correlations of .90 and .94.

Co-occurrence relationships

An examination of the recall data suggested that the Ss tended to recall groups of units from the passage which were related to one

Figure 7

Relation Between Rated Importance Scores of Idea Units and Recall after 1, 2 or 3 Presentations of the TTC Passage

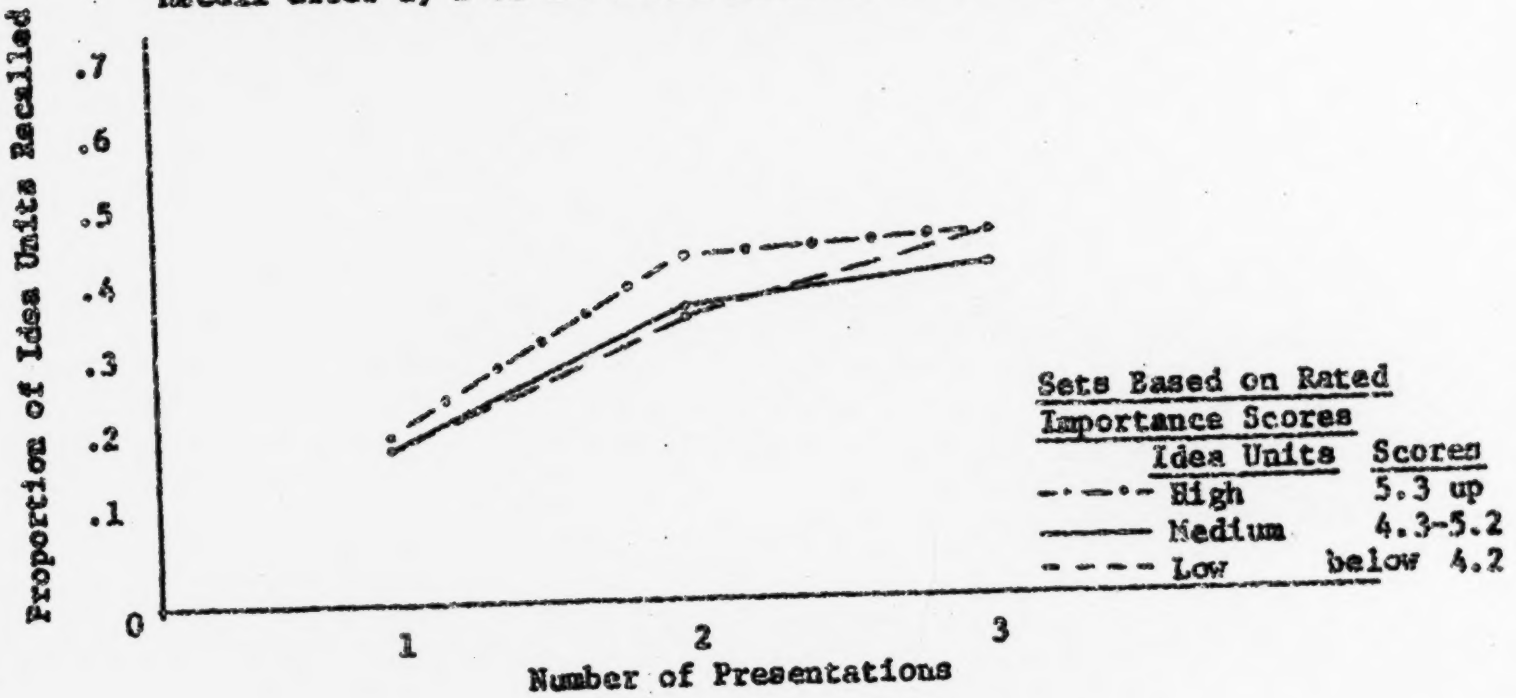
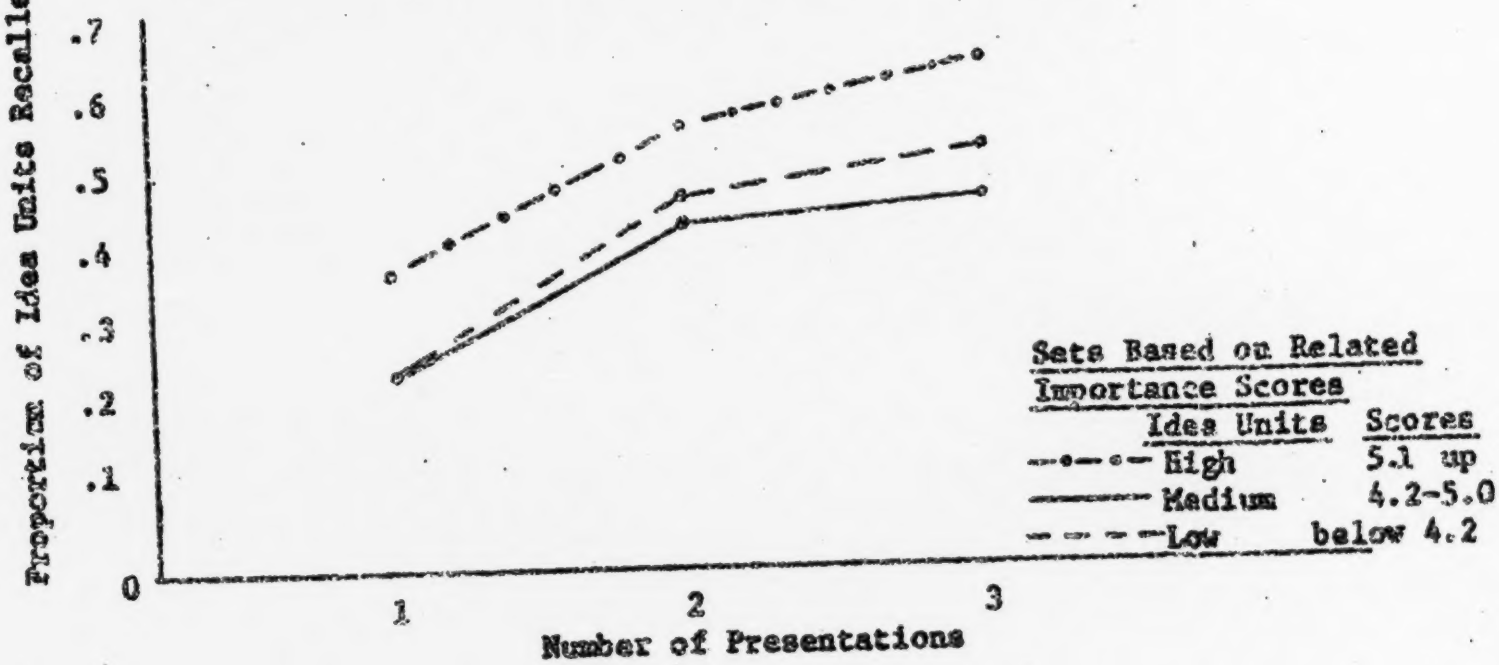


Figure 8

Relation Between Rated Importance Scores of Idea Units and Recall after 1, 2 or 3 Presentations of the FBR Passage



another in the hierarchical structure. It was thought that items higher in the hierarchy might be serving to cue the recall of those immediately beneath them. As a test of this, five Ss who heard each passage once were randomly selected and their recall data were analyzed in the following manner. For each idea unit recalled, idea X, the recall sequence was searched to see if the unit immediately above it in the hierarchical tree structure was also recalled. If so, a plus was recorded for idea X. A proportion, resulting from the number of units marked with a plus divided by the total number of units recalled, was computed for each of the selected recall protocols. An average of 69% of the idea units recalled were marked with a plus. Thus, although overall recall was only about 23% for the passages, if a particular unit was recalled then nearly 70% of the time the unit directly above it logically was also recalled. This result is compatible with the hypothesis that Ss were using units higher in the hierarchy to cue the recall of those units immediately below them.

Stability of recall

Ss' two consecutive recall attempts of the FBR passage were examined to see if the same units were recalled on both attempts. The idea units recalled by each S were divided into two groups, those recalled on both attempts (Type 2 units) and those recalled on only one attempt (Type 1 units). Number of Different Units Recalled was also computed for each S by summing the number of Type 1 and Type 2 units. Totals were then computed by summing these scores across individuals. The total number of Type 2 units for all Ss was divided by the total of the Number of Different Units Recalled, which indicated that after one presentation 72% of the idea units Ss recalled were present on both recall attempts. After two and three presentations of the passage, this value

rose to 82% and 80% respectively. However, it should be noted that the number of Type 1 units also rose with more presentations. These data are summarized in Table 2.

A further analysis was carried out to determine which idea units were most stable. A stability index for each unit was calculated in the following manner. Each time that unit was a Type 2 unit for a S, it was assigned two points. The total number of points assigned to each idea unit was calculated, then divided by the total number of Ss who recalled that unit as either a Type 1 or Type 2 unit. This index can vary from zero if the unit, when it was recalled, always occurred as a Type 1 unit, to 1.0 if the unit, when it was recalled, always occurred as a Type 2 unit. The values obtained for idea units ranged from .25 to 1.0.

To see if the stability of idea units was related to hierarchical structure or rated importance, correlations were computed between the units' stability scores and these other indices. The correlation between the stability index and the Combined Hierarchy Scores was .55 ($p < .01$). Idea units high in the logical structure are most stable. The correlation between the stability index and the Rated Importance Scores was -.25 ($p < .05$). There was actually a tendency for units rated as most important to be less stable over successive recall attempts.

DISCUSSION

There are several ways in which data on recall from prose resembles data on recall from word lists. Repeated presentations produce diminishing increments in the amount recalled. There is evidence of some form of clustering. And on successive recall attempts, without

Table 2

Stability of Idea Units in Consecutive Recall Protocols after 1, 2 or 3 Presentations of the FBR Passage

Presentations	Mean Number Recalled		Proportion of Recalled Items that are Type 1
	Type 1	Type 2	
1	17.96	7.08	.28
2	34.43	7.39	.18
3	35.91	9.26	.20

intervening presentations, Ss recall somewhat different sets of items, although averaging about the same total number of items recalled.

Differences in items recalled on successive attempts has been taken as evidence that failure to recall information is at least partially the result of retrieval failures rather than loss from memory. Some have suggested that the retrieval mechanism, rather than the storage mechanism, is the restrictive link in the information processine procedure (Miller, Galanter, and Pribram, 1960; Tulving; 1967). Mandler (1967) has suggested that the restrictions in retrieving information are overcome through organizing the information into larger cognitive units. It might be expected, then, that since natural prose of the type used in this study has a much tigher logical structure than the word lists used in most free recall studies, the stability of recall over successive recall attempts would be greatly increased. It is somewhat surprising to find that after a single presentation 28% of the units recalled were recalled on only a single attempt. This is probably less instability than that found by Tulving with word lists, who reported that only 50% of the words recalled were recalled on all three recall attempts in his study. Still, given that the present study used one less recall attempt, the amount of instability found in the data is considerable. The effect of the logical structure of the passage did not appear to be very powerful in producing greater recall stability.

The stability of individual idea units was found to be substantially related to their position in the logical structure of the passage, a point which will be discussed later. On the other hand, the relationship between stability and the perceived importance of idea units was small, though significant, and negative in direction. The

only comparable study was by Johnson (1970) who indexed units on stability according to whether they were recalled on two attempts separated by 21 days, and found no relationship of stability to rated importance.

Idea units vary greatly in their recall frequency, some being recalled by most Ss and others by practically none. These differences were related to some of the variables investigated in the present study. Unlike results from word list studies, recall frequency from natural prose does not seem to be related to serial position. Primacy and recency effects like those observed in word list studies have been reported in studies which involve sentences that are relatively independent of one another, such as lists of unrelated sentences, or passages so constructed that sentence order can be rearranged without disrupting the meaning of the passage (Deese and Kaufman, 1957; Frase, 1969; Kircher, 1971). With natural prose, however, serial position effects have not been consistent from study to study, or, within the same study, from passage to passage. Thus, it seems reasonable to conclude that the serial position effects which have been observed in recall from natural prose have resulted from the effects of other variables; for instance, from a relationship between serial position and the logical structure of the passage.

On the other hand, the order in which idea units are recalled is very closely related to the serial order of the units in the passage, a finding noted earlier by Bartlett (1932) and by Deese and Kaufman (1957). However, in the passages used for the present study the branches of the hierarchical structure tended to be organized somewhat sequentially; that is, idea units higher in the hierarchy on a particular branch tended to appear earlier in the passage than those further down the branch. Thus, serial position and logical structure were confounded

variables. This leaves the possibility that order of recall was actually being controlled primarily by logical structure rather than simply by presentation order. Further research will be needed to evaluate this possibility.

The other two variables studied, logical structure and rated importance, both were related to frequency of recall of idea units. In general, the logical structure showed the strongest relationship. In fact, it may be that much of the effect of rated importance on recall results from relationship between rated importance and logical structure. Weak evidence for this suggestion comes from a comparison of the two passages used in the present study. The Rated Importance Score and Combined Hierarchy Score correlated .59 ($p < .01$) for the FBR passage, but only .07 for the TTC passage. The FBR passage showed a much stronger relation between rated importance and recall than did the TTC passage. It may be that the TTC passage data actually presents a less confounded estimate of the relation between rated importance of ideas and their likelihood of being recalled. For this passage the relationship, though significant, was not strong.

The present study has shown that in general people tend to be most proficient in recalling information that is high in the logical structure of a passage. An examination of the passages used indicated that this information is typically the most general information in a passage, and is in contrast to that which is more specific and found in the lower portion of the hierarchically arranged, logical structure. Although this higher level information was recalled best by the Ss, some very specific idea units at the lower levels of the logical structure were also remembered very well. These tended to be either numbers or familiar names,

in the present study.

The rate at which the recall frequency of idea units increased with additional presentations was not affected by any of the variables studied. Learning curves for high, medium and low units on each variable were quite parallel. Where a significant interaction occurred for one passage between the levels of some variable and the number of presentations, the interaction was not present in the other. This leads to the conclusion that the variables studied do not influence the rate of learning after the first presentation. All groups of idea units appeared to be learned at about the same rate, thus generally maintaining the recall frequency differences that existed after the first presentation. If units high in the logical hierarchy of a passage can be accepted as being the main ideas of the passage, then these results relate to the controversy of whether students learn main ideas first, then add details, or whether they first acquire details and only later learn the main ideas.

From Ausubel's (1963) view of cognitive structure and dynamics, it might have been expected that on the first reading of a passage Ss would primarily acquire the main, more abstract ideas high in the hierarchy. These then would serve as suborganizers with more specific details being acquired on later trials as they were fitted into the overall structure of the passage. The data supported the first hypothesis, that main ideas would be recalled best after the first presentation, but the expected change after additional presentations was not found. It should also be noted that Ausubel's position would suggest that units high in the hierarchy would be the most stable over a series of recall attempts. This was indeed found in the present study, as previously mentioned.

Another view of learning from prose is that put forth in reading

programs with lessons which emphasize that students should seek to acquire details first and then to learn main ideas as they are seen to be based on the details (Glock, 1954, 1967). The data clearly indicate that this is not the normal approach used by the college students participating in this study. Whether such an approach would increase retention is, of course, not answered by the present data.

In conclusion, this study has demonstrated that it is possible to reliably classify information in prose according to its position in the logical, hierarchical structure of the discourse. This variable, position in the logical hierarchy, was found to be important in determining which information tends to be recalled from the passage, and which will be most stable over multiple recall attempts. A main weakness of the study came in the subjective methods used to identify idea units. It is of interest that recent work of linguists (Frantz, 1970; Longacre, 1970; Grimes, 1972) has been aimed at providing more objective methods of analyzing the logical structure of discourse. Their work may provide better methods for allowing psychologists to explore the effects of this important variable. If objective methods of specifying the logical structure of a passage can be devised, this may also overcome a primary limitation in present research involving natural prose. At present, experimental results obtained from using one passage often do not generalize to another passage. Being able to classify passages according to certain aspects of their logical structure may yield categories of passages in which certain variables behave consistently. In addition, it seems reasonable to assume that the act of reading or hearing a passage has the effect of establishing a pattern of logical relations in the person's mind, which is revealed to some degree through his recall and his answers to questions. Having the ability to make explicit

the logical structure of a passage may permit the comparison of this structure with that created in the reader or hearer, showing changes in the structure which take place in learning and forgetting. Such an approach would essentially be an extension of research initiated by Dawes (1966).

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